Summers Inverse Cyclotron

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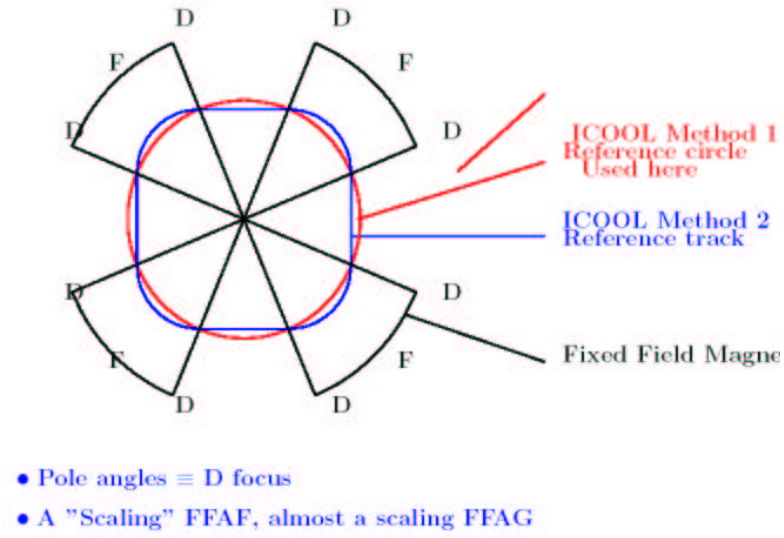
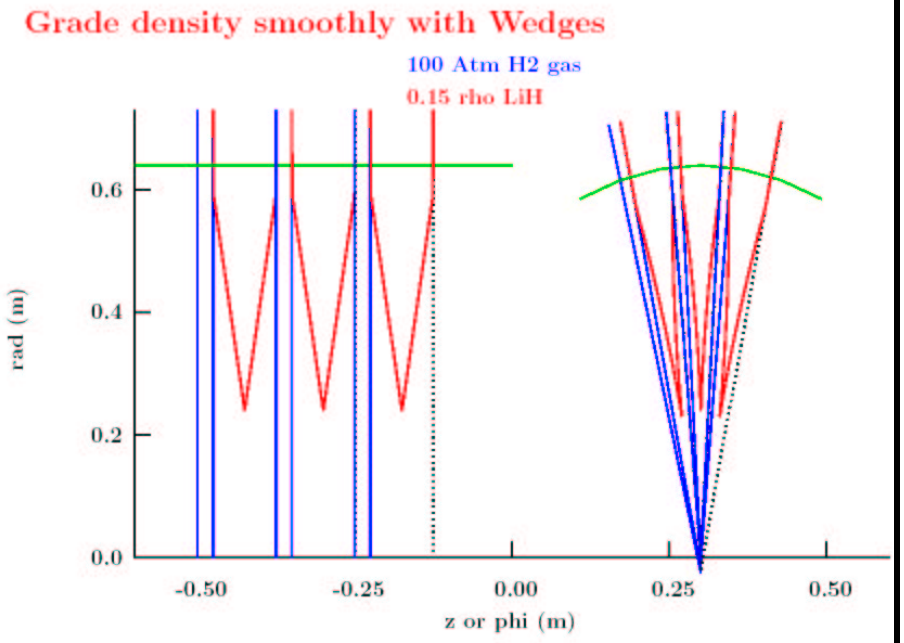
MUCOOL Friday Meeting

Introduction

- We are using Kirk and Garren's Ring with Palmer's sinusoidal field
  - Radius of reference orbit is 63.7037 cm
  - Each cell is 1.00065 m long with 45 degrees
  - Whole ring filled with high pressure H2 gas
  - Fine wedges with smooth grade density
- Ring and wedges geometry (R. Palmer):





ICOOL in LINUX

☐ We have installed ICOOL 2.85 in LINUX at Mississippi

- Change all ext from *.for to *.f
- Convert the files from windows to linux (dos2unix)
- Include appropriate files: iunix.f, iunixc.c and gmake
- Recompile all code in Linux and test it
- It works fine so far!

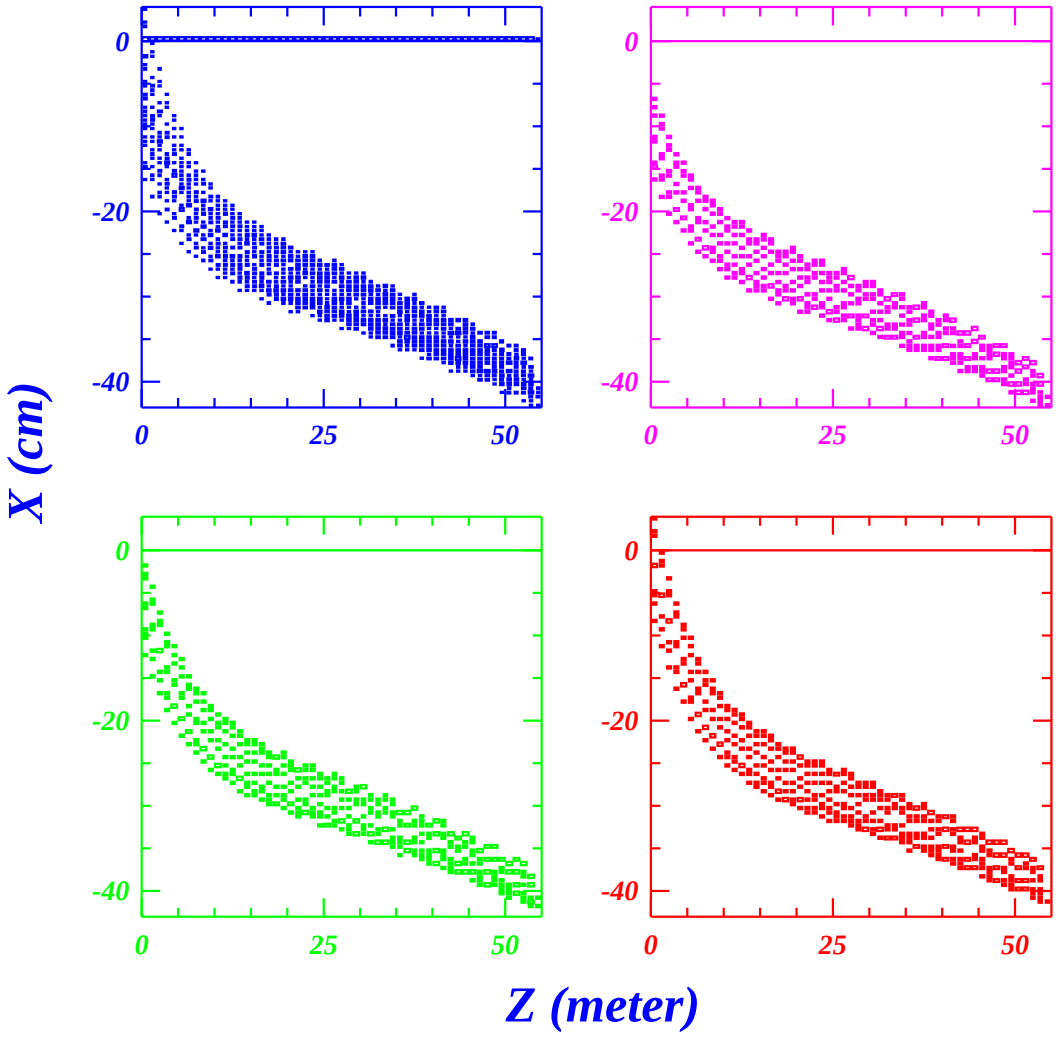
☐ We injected 3 tracks (muon) with momentum:

- 157 MeV/c (- 9% dp/p)
- 172 MeV/c (nominal value)
- 187 MeV/c (+ 9% dp/p)

☐ Let energy loss, dE/dx, naturally inject the particles

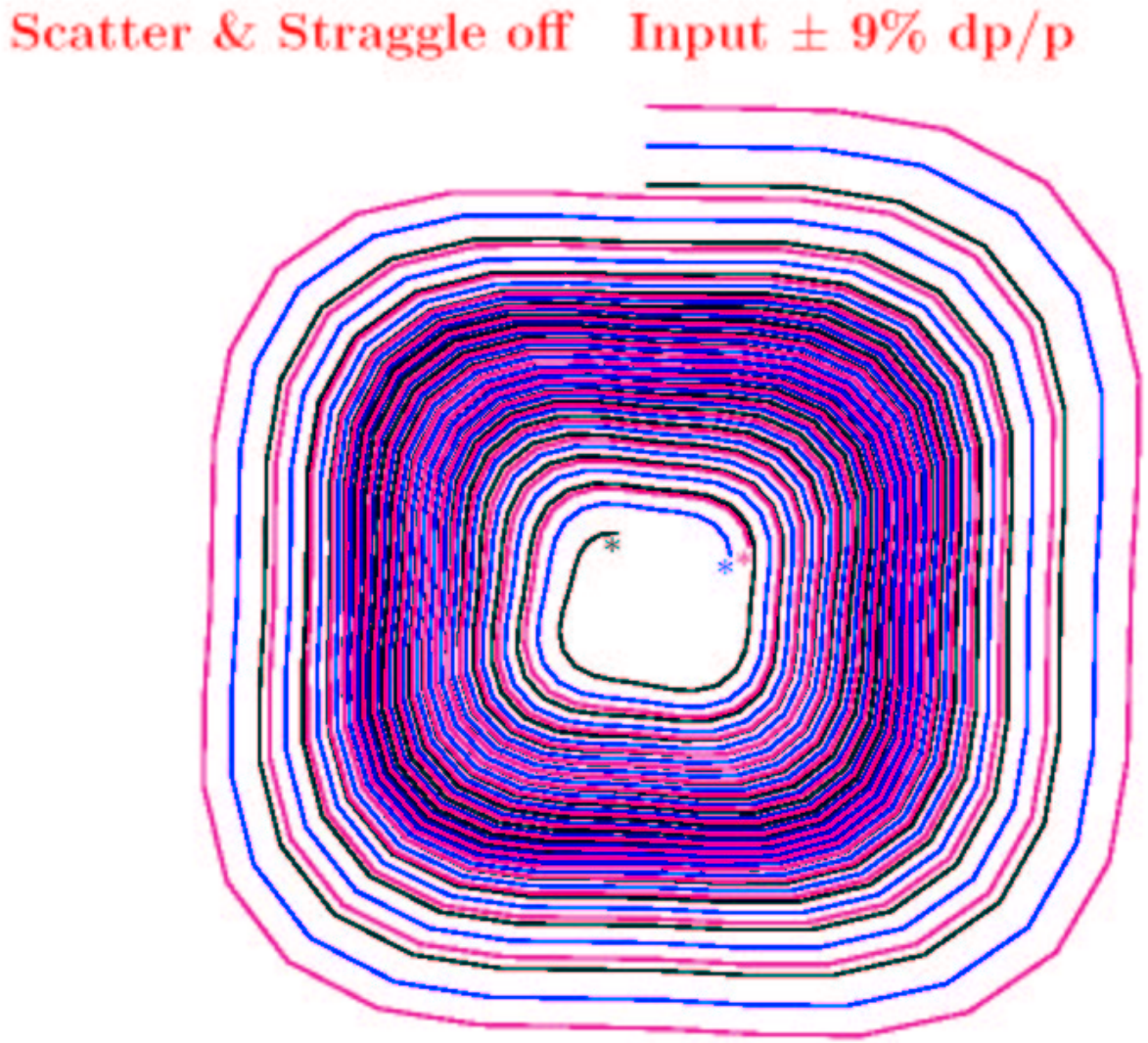
scattering and straggling process are off at the moment

100 Atm H2 Gas : X Vs Z



Order : All tracks, 157 MeV/c, 172 MeV/c, and 187 MeV/c (red)

Three Tracks Injection (Palmer)



Order : 157 MeV/c, 172 MeV/c, and 187 MeV/c

Coordinate Transformation

$s = R_{nbt}\, b$

$H = R_{nbt} + x' = \mathrm{sqrt}(X^2 + Z^2)$

$X = (R_{nbt} + x') \cos b$

$Y = y'$

$Z = (R_{nbt} + x') \sin b$

$b = \mathrm{atan2}\,(Z, X)$

$y' = Y$

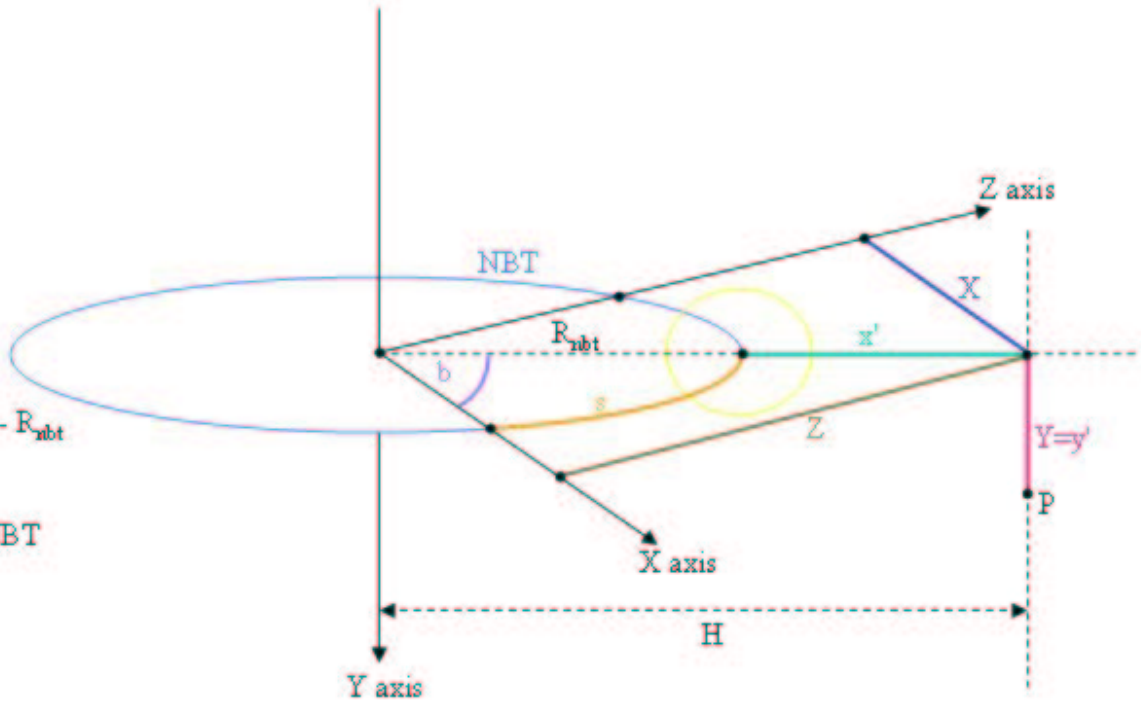
$x' = H - R_{nbt} = \mathrm{sqrt}(X^2 + Z^2) - R_{nbt}$

Unit Vectors:

e_b -- parallel to tangent to NBT

$e_{y'}$ -- vertically downward

$e_{x'}$ -- radially outward



- ICOOL uses Frenet-Serret Coordinates
- NBT = Nominal Beam Trajectory
  - X = horizontal distance from NBT
  - Y = vertical distance from NBT
  - Z = a distance from starting point along NBT

MUON Capture Solution

- Slow Negative Muon Capture Solution, when muons stop in the center
- Surface Muon Beams use Positive Muons
- Negative Muons are Captured by Nuclei
- Use Muon Catalyzed Fusion to free
  Negative Muons that may be Captured
- Probability that a muon will stick to newly formed He nucleus
  (Panomarev, Contemporary Physics, 31, 219, 1990)
  - D D mu $\longrightarrow$ 0.12
  - D T mu $\longrightarrow$ 0.0043
- In a Deuterium-Tritium Mixture a D T mu molecule is rapidly formed, regardless of how the muon is first captured
- The 12% D D mu sticking factor might be enough
  Only Deuterium would be used; no radioactive Tritium
- Gas Pressure $\sim$ 1/1000 Atmosphere